

74AHC273; 74AHCT273

Octal D-type flip-flop with reset; positive-edge trigger

Rev. 4 — 23 September 2020

Product data sheet

1. General description

The 74AHC273; 74AHCT273 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard No. 7-A.

The 74AHC273; 74AHCT273 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common clock (CP) and master reset (\overline{MR}) inputs, load and reset (clear) all flip-flops simultaneously. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding output (Qn) of the flip-flop. All outputs will be forced LOW, independent of clock or data inputs, by a LOW on the \overline{MR} input.

The device is useful for applications where only the true output is required and the clock and master reset are common to all storage elements.

2. Features

- Balanced propagation delays
- All inputs have Schmitt-trigger actions
- Inputs accept voltages higher than V_{CC}
- Ideal buffer for MOS microcontroller or memory
- Common clock and master reset
- Input levels:
 - For 74AHC273: CMOS level
 - For 74AHCT273: TTL level
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101C exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC273D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74AHCT273D				
74AHC273PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74AHCT273PW				
74AHC273BQ	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1
74AHCT273BQ				

4. Functional diagram

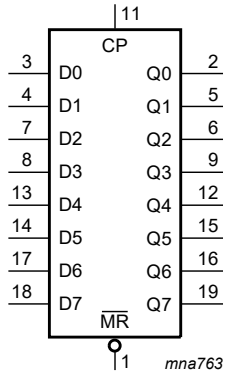


Fig. 1. Logic symbol

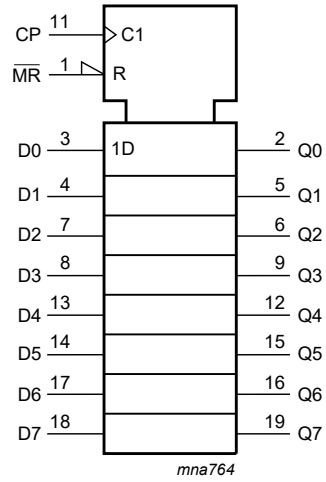


Fig. 2. IEC logic symbol

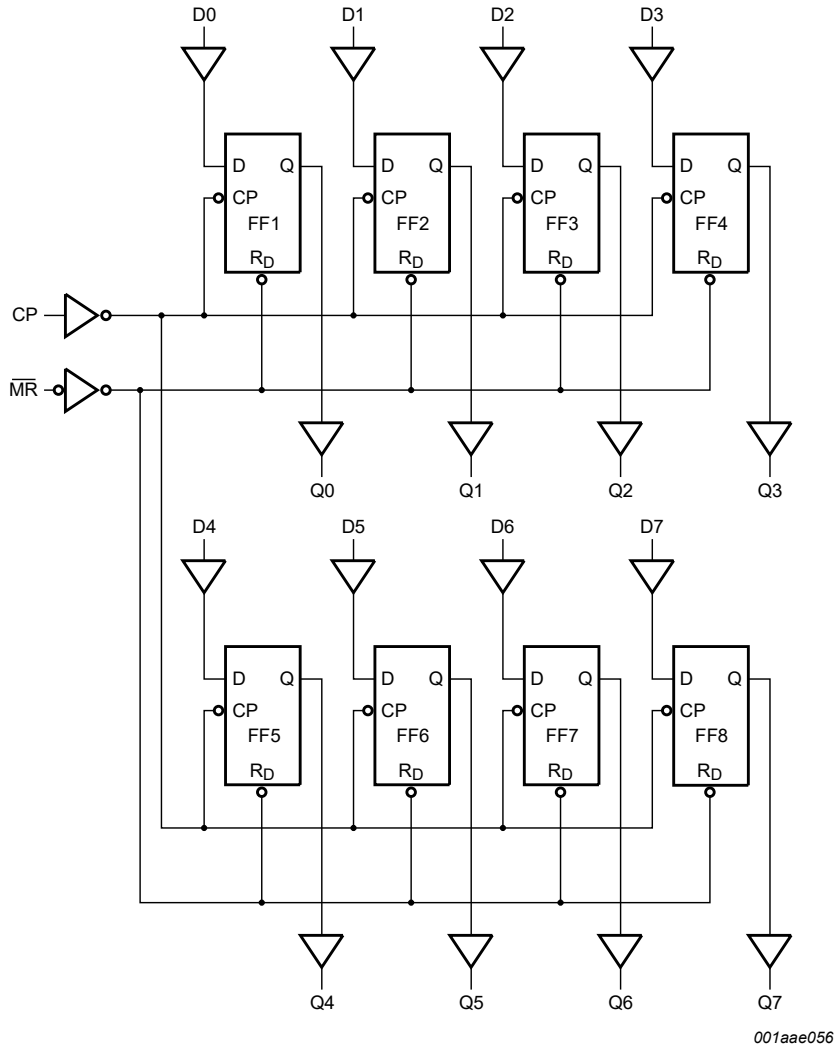


Fig. 3. Logic diagram

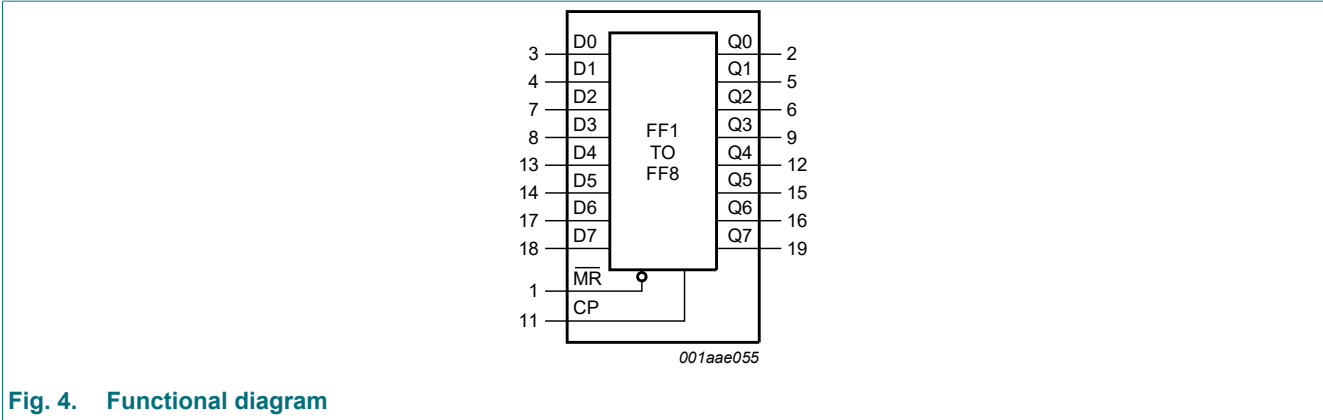


Fig. 4. Functional diagram

5. Pinning information

5.1. Pinning

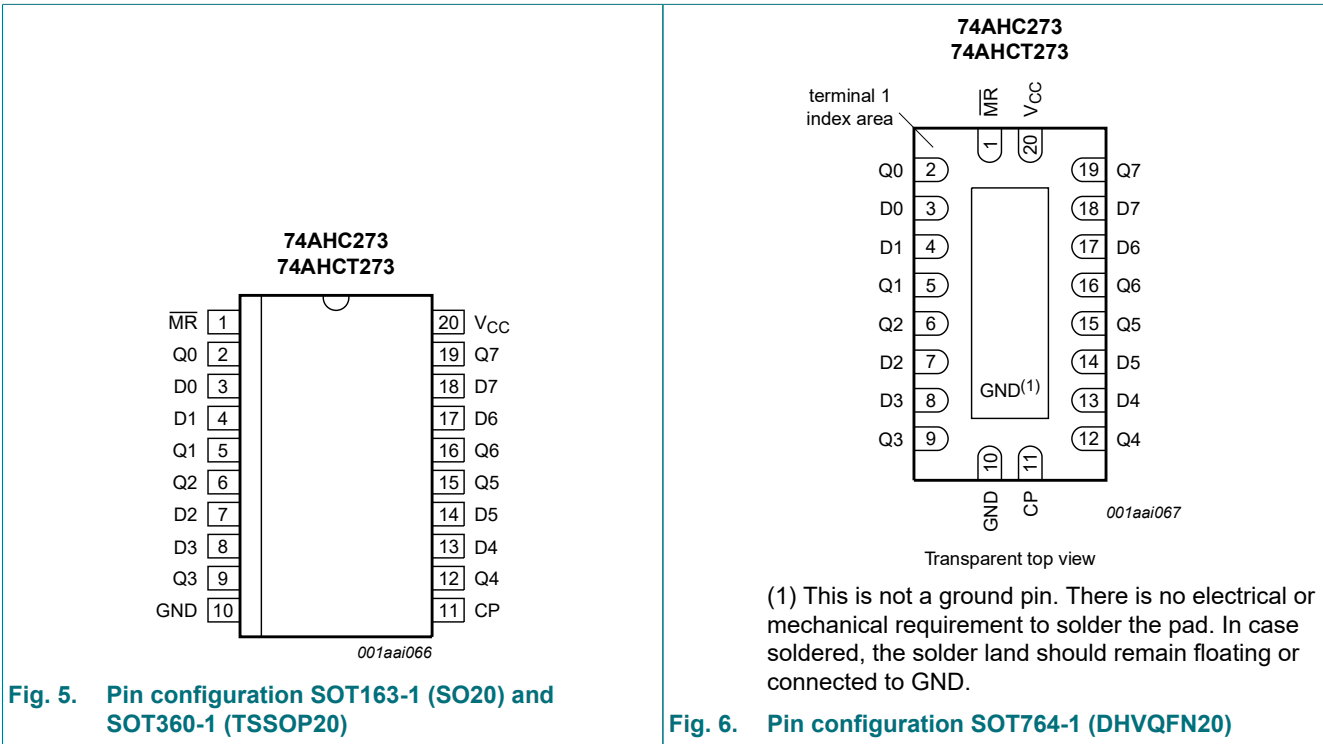


Fig. 5. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)

Fig. 6. Pin configuration SOT764-1 (DHVQFN20)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
MR	1	master reset input (active LOW)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	2, 5, 6, 9, 12, 15, 16, 19	flip-flop output
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data input
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH edge-triggered)
VCC	20	supply voltage

6. Functional description

Table 3. Function table

*H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;
L = LOW voltage level; l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
↑ = LOW-to-HIGH; X = don't care.*

Operating mode	Control		Input	Output
	MR	CP	Dn	Qn
Reset (clear)	L	X	X	L
Load '1'	H	↑	h	H
Load '0'	H	↑	l	L

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+7.0	V
V_I	input voltage		-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ [1]	-20	-	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-20	+20	mA
I_O	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$	-25	+25	mA
I_{CC}	supply current		-	+75	mA
I_{GND}	ground current		-75	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.
For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.
For SOT764-1 (DHFQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC273			74AHCT273			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$	-	-	20	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC273										
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = -50 µA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -50 µA; V _{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I _O = -50 µA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA; V _{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
I _O = -8.0 mA; V _{CC} = 4.5 V	3.94	-	-	3.80	-	3.70	-	V		
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = 50 µA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 µA; V _{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 µA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
I _O = 8.0 mA; V _{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V		
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	4.0	-	40	-	80	µA
C _I	input capacitance		-	3	10	-	10	-	10	pF
C _O	output capacitance		-	4	-	-	-	-	-	pF

Octal D-type flip-flop with reset; positive-edge trigger

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT273										
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = -50 µA	4.4	-	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	4.0	-	40	-	80	µA
ΔI _{CC}	additional supply current	per input pin; V _I = V _{CC} - 2.1 V; other pins at V _{CC} or GND; I _O = 0 A; V _{CC} = 4.5 V to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C _I	input capacitance		-	3	10	-	10	-	10	pF
C _O	output capacitance		-	4	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 10.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC273										
t _{pd}	propagation delay	CP to Qn; see Fig. 7 [2]								
		V _{CC} = 3.0 V to 3.6 V								
		C _L = 15 pF	-	6.0	13.6	1.0	16.0	1.0	17.0	ns
		C _L = 50 pF	-	8.6	17.1	1.0	19.5	1.0	21.5	ns
		V _{CC} = 4.5 V to 5.5 V								
		C _L = 15 pF	-	4.2	9	1.0	10.5	1.0	11.5	ns
		C _L = 50 pF	-	6.0	11.0	1.0	12.5	1.0	14.0	ns
		MR to Qn; see Fig. 8 [3]								
		V _{CC} = 3.0 V to 3.6 V								
		C _L = 15 pF	-	5.1	13.6	1.0	16.0	1.0	17.0	ns
		C _L = 50 pF	-	7.3	17.1	1.0	19.5	1.0	21.5	ns
		V _{CC} = 4.5 V to 5.5 V								
		C _L = 15 pF	-	3.7	8.5	1.0	10.0	1.0	11.0	ns
		C _L = 50 pF	-	5.3	10.5	1.0	12.0	1.0	13.5	ns

Octal D-type flip-flop with reset; positive-edge trigger

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
f _{max}	maximum frequency	see Fig. 7								
		V _{CC} = 3.0 V to 3.6 V								
		C _L = 15 pF	75	120	-	65	-	65	-	MHz
		C _L = 50 pF	50	75	-	45	-	45	-	MHz
		V _{CC} = 4.5 V to 5.5 V								
		C _L = 15 pF	120	165	-	100	-	100	-	MHz
		C _L = 50 pF	80	110	-	70	-	70	-	MHz
t _w	pulse width	CP HIGH or LOW; see Fig. 7								
		V _{CC} = 3.0 V to 3.6 V	5.0	-	-	6.5	-	6.5	-	ns
		V _{CC} = 4.5 V to 5.5 V	5.0	-	-	5.0	-	5.0	-	ns
		MR LOW; see Fig. 8								
		V _{CC} = 3.0 V to 3.6 V	5.0	-	-	6.0	-	6.0	-	ns
		V _{CC} = 4.5 V to 5.5 V	5.0	-	-	5.0	-	5.0	-	ns
t _{su}	set-up time	Dn to CP; see Fig. 9								
		V _{CC} = 3.0 V to 3.6 V	3.0	-	-	3.0	-	3.0	-	ns
		V _{CC} = 4.5 V to 5.5 V	3.0	-	-	3.0	-	3.0	-	ns
t _h	hold time	Dn to CP; see Fig. 9								
		V _{CC} = 3.0 V to 3.6 V	1.0	-	-	1.0	-	1.0	-	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	-	-	1.0	-	1.0	-	ns
t _{rec}	recovery time	MR to CP; see Fig. 8								
		V _{CC} = 3.0 V to 3.6 V	2.5	-	-	2.5	-	2.5	-	ns
		V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	ns
C _{PD}	power dissipation capacitance	f _i = 1 MHz; V _I = GND to V _{CC} [4]	-	14	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHCT273; V_{CC} = 4.5 V to 5.5 V										
t _{pd}	propagation delay	CP to Qn; see Fig. 7 [2]								
		C _L = 15 pF	-	4.0	7.5	1.0	8.8	1.0	9.5	ns
		C _L = 50 pF	-	5.8	9.2	1.0	10.5	1.0	11.5	ns
		MR to Qn; see Fig. 8 [3]								
		C _L = 15 pF	-	3.9	10.0	1.0	11.6	1.0	12.5	ns
		C _L = 50 pF	-	5.6	11.0	1.0	12.6	1.0	14.0	ns
f _{max}	maximum frequency	see Fig. 7								
		C _L = 15 pF	75	120	-	65	-	65	-	MHz
		C _L = 50 pF	50	75	-	45	-	45	-	MHz
t _w	pulse width	CP HIGH or LOW; see Fig. 7	5.0	-	-	6.5	-	6.5	-	ns
		MR LOW; see Fig. 8	5.0	-	-	6.0	-	6.0	-	ns
t _{su}	set-up time	Dn to CP; see Fig. 9	3.0	-	-	3.0	-	3.0	-	ns
t _h	hold time	Dn to CP; see Fig. 9	1.0	-	-	1.0	-	1.0	-	ns
t _{rec}	recovery time	MR to CP; see Fig. 8	2.5	-	-	2.5	-	2.5	-	ns
C _{PD}	power dissipation capacitance	f _i = 1 MHz; V _I = GND to V _{CC} [4]	-	18	-	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V and V_{CC} = 5.0 V).

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] t_{pd} is the same as t_{PHL} only.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$$

where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

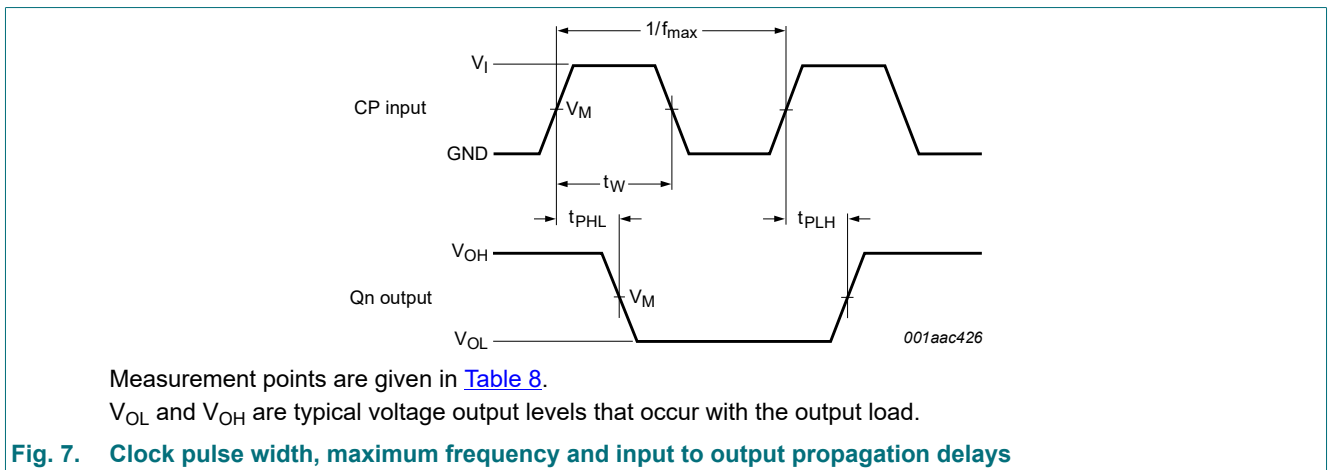
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of the outputs.

10.1. Waveforms and test circuit



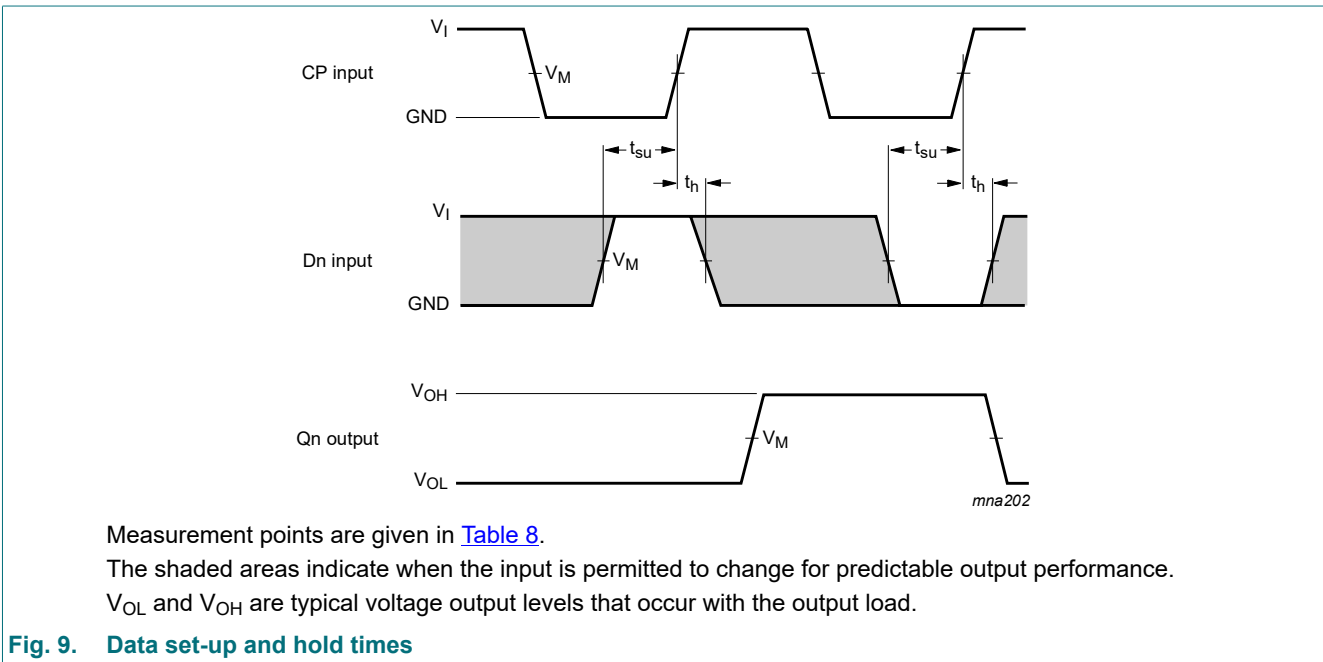
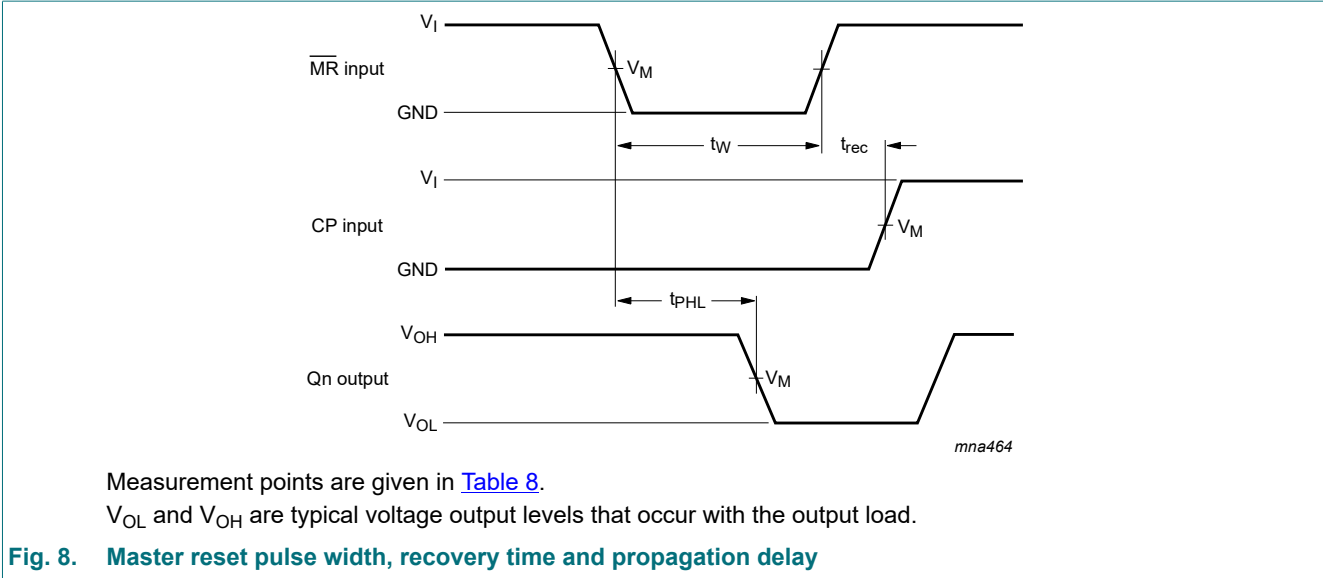


Table 8. Measurement points

Type	Input	Output
	V_M	V_M
74AHC273	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT273	1.5 V	$0.5 \times V_{CC}$

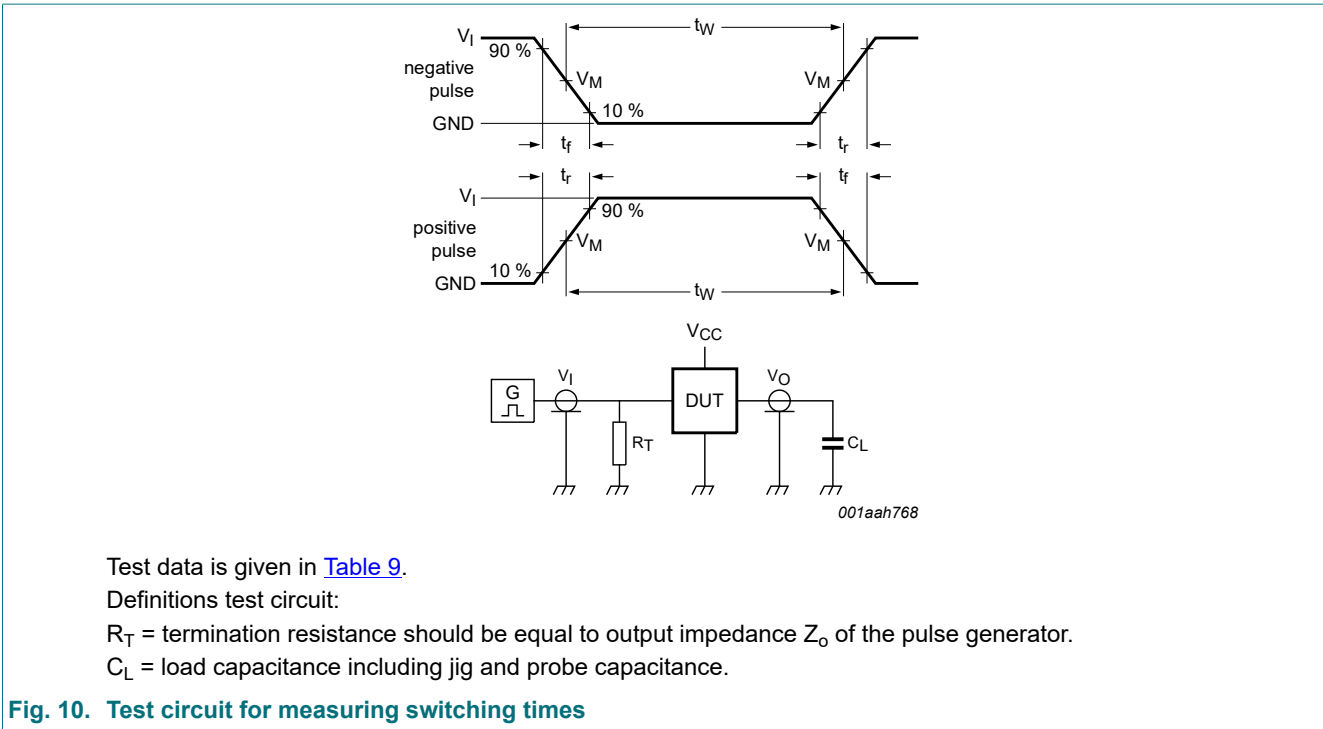


Table 9. Test data

Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
74AHC273	V_{CC}	≤ 3.0 ns	15 pF, 50 pF	t_{PLH}, t_{PHL}
74AHCT273	3.0 V	≤ 3.0 ns	15 pF, 50 pF	t_{PLH}, t_{PHL}

11. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

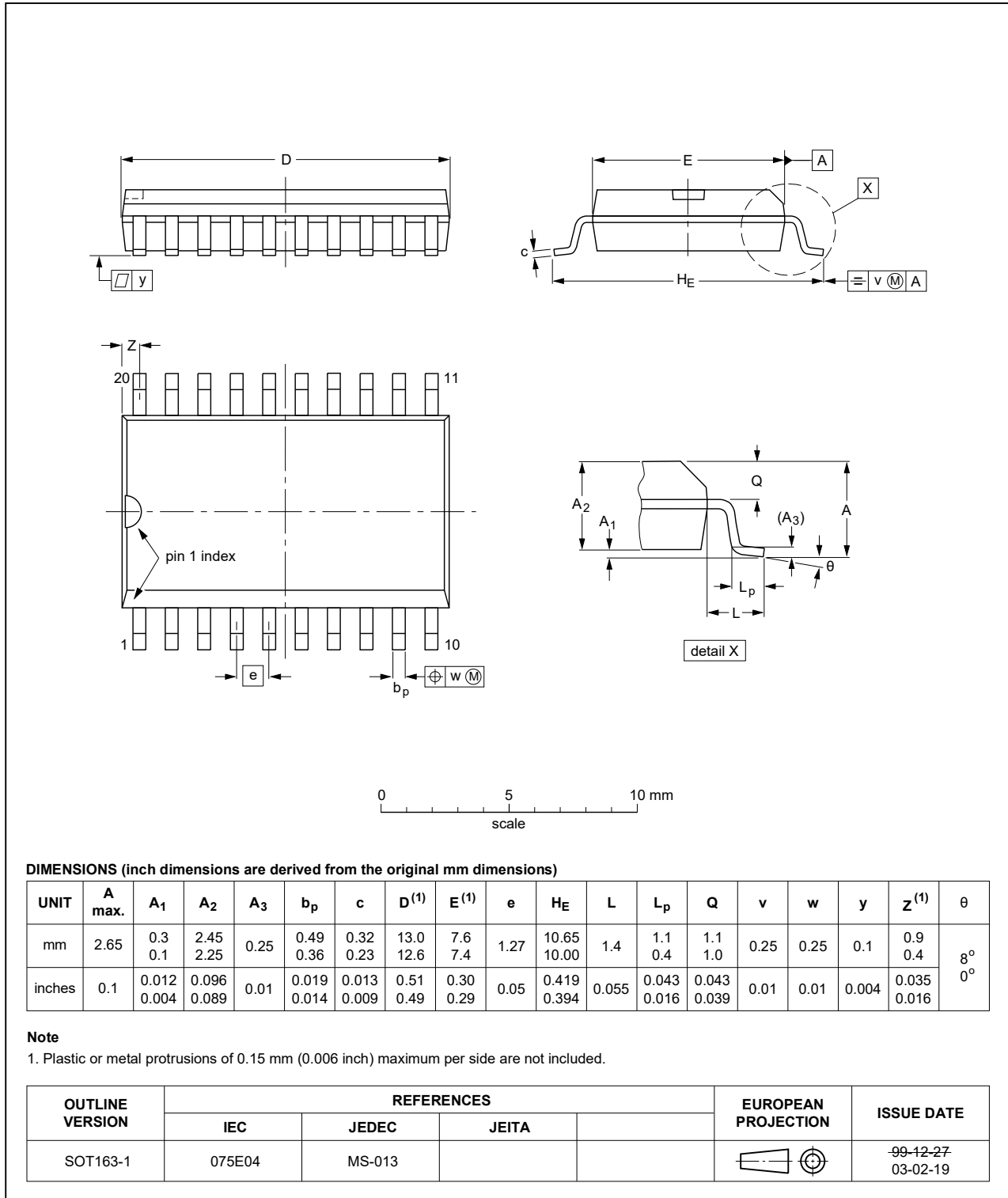


Fig. 11. Package outline SOT163-1 (SO20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

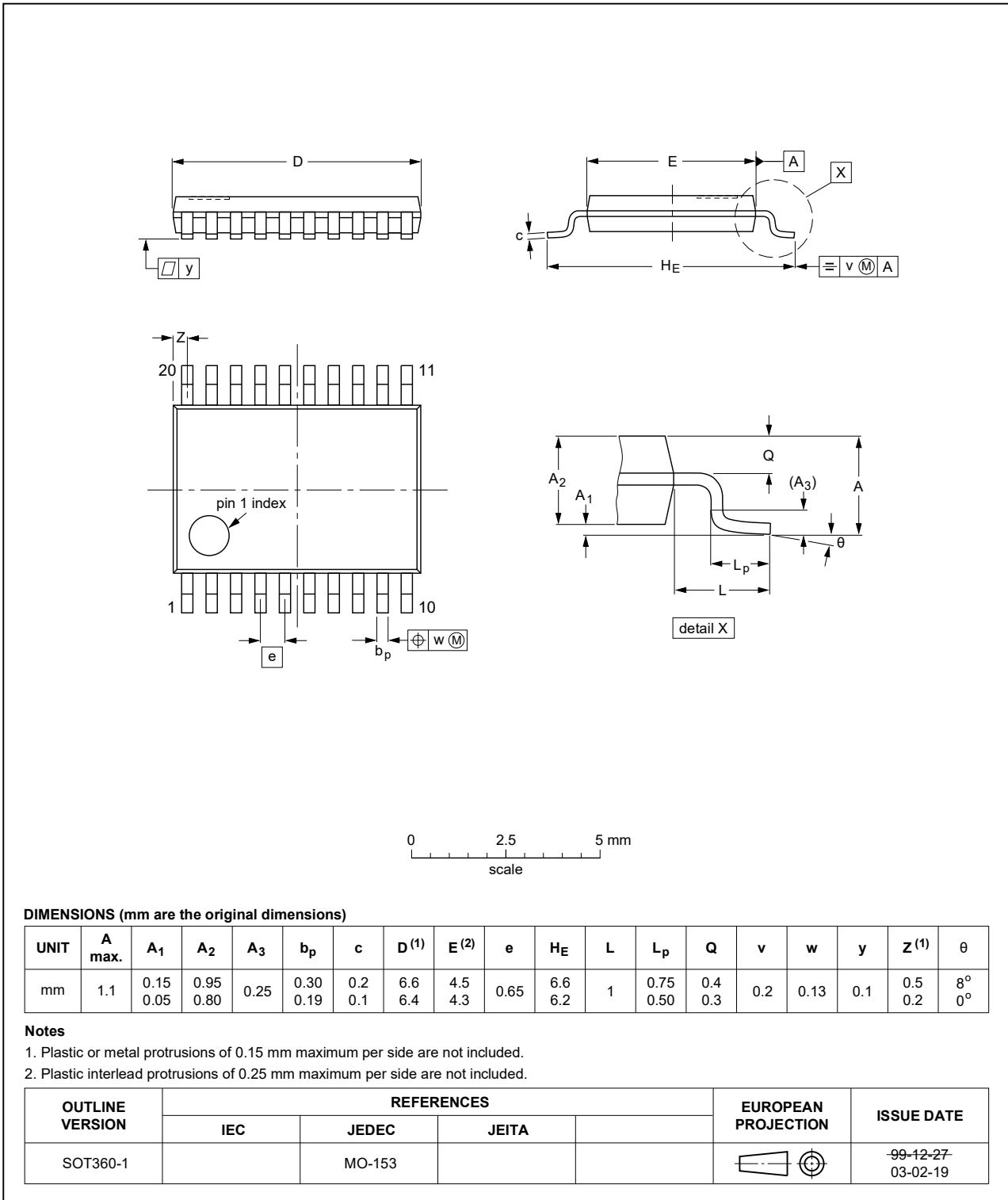


Fig. 12. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1



Fig. 13. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MM	Machine Model
MOS	Metal-Oxide Semiconductor

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT273 v.4	20200923	Product data sheet	-	74AHC_AHCT273 v.3
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation have been updated. Package outline drawing of SOT764-1 (Fig. 13) updated. 			
74AHC_AHCT273 v.3	20080513	Product data sheet	-	74AHC_AHCT273 v.2
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Table 6: the conditions for input leakage current have been changed. 			
74AHC_AHCT273 v.2	20030721	Product specification	-	74AHC_AHCT273 v.1
74AHC_AHCT273 v.1	19990901	Product specification	-	-

14. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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